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ABSTRACT

This paper analyzed factors related to adoption of new farm practices by dairy farmers in two Pennsylvania counties in 1962 and 1966. (Of 638 farmers interviewed in 1962, 387 were still operating their farms in 1966.) The dependent variable was an index of 19 recommended farm practices, of which about half were being used in 1962. Twenty-one independent variables were used to measure social participation, personal characteristics, and structural factors of the farm operation. Statistical analysis in 1962 indicated that only four of these 24 variables (residence, farm machinery, participation in farm organizations, participation in agricultural extension programs) were significantly related to the dependent variable. In 1966, the mean index showed an increase of two practices. Four independent variables (age, residence, farm machinery, participation in agricultural extension programs) proved significant in 1966, accounting for 45% of the explained variance in farm practices. (Nine tables are included.) (author/ly)

Factors Related to the Adoption of Farm Practices

1962 - 1966*

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An educational program is often used to diffuse new ideas and technology, and represents an area of micro-social change. One illustration is the rapid diffusion of new farm practices in agriculture. One American farmer in 1968 produced enough food and fiber for himself and forty eight other people. In 1917 the ratio was one to seventeen. This increased production has come from fewer farms. The number of Americans engaged in farming decreased from 30 per cent in 1920 to 6 per cent in 1960. It is estimated that about 3 per cent of farms are closed each year. The process of diffusion has become institutionalized through legislation creating the Land Grant system of research-teaching-extension, the mass media, agri-business, and national farm organizations. For at least a half century, social scientists have been studying how farm people adopt new practices. This research tradition has now expanded to include education, medicine, and several other disciplines.

The major objectives of this paper are to analyze the factors related to the adoption of farm practices by dairy farmers in two Pennsylvania Counties in 1962 and 1966. Research design uses time series data to analyze the relationships in the two time periods. The theoretical framework suggests that modern agriculture requires the farmer to perform a new role, that is the role of the farmer-scientist who uses rational knowledge to make decisions about farming. This is contrasted with the

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traditional role of the farmer who uses "common sense" knowledge gained from experience in making decisions.

Six hundred and thirty-two dairy farmers were interviewed in 1962 in Indiana and Susquehana County of Pennsylvania as part of a Benchmark Study. In 1966 they were re-interviewed. In the interim period about thirty nine per cent had dropped out of farming, or quit dairy farming. Data for this report pertains to the three hundred and eighty-seven farmers who were operating the same dairy farms in 1962 and 1966.

Adoption is measured by an index of 19 practices recommended for dairy farmers by agricultural extension specialists. The index was adjusted for each farm. If a farmer did not have any acreage in permanent pasture, this item was deleted from the index.

There are different stages in the adoption process, identified as awareness, interest, trial, evaluation, and adoption. Adoption is defined as an observed behavioral act whereby the farmer uses a new farm practice.

Literature Review

Over one hundred different sources were reviewed relating to adoption of new ideas and technology. Most of the studies were related to agriculture, but others included medicine, education, and industrial innovations.

The communication factor is related to adoption. This factor includes impersonal sources such as the mass media as well as personal sources such as friends and neighbors. The literature indicated the importance of different sources at different times in the process. When a person first thought of using a new practice, he sought the advice of friends. When he actually began to use the practice he relied more upon

the advice of agricultural specialists. A theory of cognitive dissonance was proposed to show how individuals rationalize information, so that there is no conflict between belief and behavior. Of interest in the literature reviewed was the importance of government officials as sources of information in developing countries.

Personal factors such as age, education, family, values, and influence of the neighborhood are related to adoption. Age has a negative influence. An older person has more difficulty learning a new role, and accepting new ideas. Education offers the person new alternative courses of action. It is evident the farmer looks to his neighbors as he begins to adopt new practices. If the neighborhood is rather conservative, he will not adopt the practice. His self image is also important. If he perceives of himself as an innovator, then he is more likely to use the new practice.

Structural factors are another important influence upon adoption. Farmers who adopt new practices generally operate larger and more specialized farm units. They substitute capital and machinery for labor inputs. Due to mechanization, they can expand their operations. The structural factors may serve as constraints to adoption. A farmer may want to use a new practice, but lack the necessary capital or acreage to implement the practice.

The literature indicated the importance of the participation factor. Farmers who adopt new practices generally participate more in formal organizations. This would indicate a tendency for interaction with persons whose goals are similar.

Time is a necessary element in the diffusion process. A farmer needs to be able to use the practice, to evaluate it, and then to fit it into his farm operation. The literature on industrial innovations

indicated a time lag between introduction and use of a new innovation.

Methodology

Multiple Regression statistical technique was used to analyze the 1962 and 1966 data using a program written for the IBM 360 computer. Eighteen independent variables were used to measure the communication, structural, personal, and participation factor. A multi-variable design was used because relationships are more multiple than singular.

Participation Factor is measured by 3 variables, participation in Agricultural Extension Programs, participation in Farm Organizations, and number of Weeks Worked Off the Farm. The Personal Factor is measured by Age, Education, Household Conveniences, Values, Self Perception, Perception of Neighborhood, Satisfaction with Farming, and Perception about Continuing in Farming and County. Communication Factor is measured by Number of Status Farmers Known, Number of Status Farmers Talked to about Farming, and Number of Daily Papers Received. Structural Factor is measured by Farm Equipment Index, Acreage Farmed, Number of Cows in Milking Herd, and Farm Income.

Specific Hypotheses tested were:

1. The Farm Practice Index in One County Would be Higher than in the Other County.
2. The Practice Index Scores in 1966 would be higher than in 1962.
3. The Factors Accounting for most of the Explained Variation in the Adoption Index in 1962 would be the same in 1966.

Analysis-1962 Data

In 1962, Indiana County farmers on the average used about 9 of the 19 practices, for Susquehana County the average was 7 practices.

Eighteen independent variables in 1962 accounted for 53 per cent of the explained variation in the adoption index. With a Step-Wise computer program, 9 remained accounting for about 50 per cent of the explained variation. The computer program drops variables that do not contribute to the amount of explained variation. These were: Structural Factor, Farm Equipment Index. Participation Factor, Participation in Agricultural Extension Programs, Participation in Farm Organizations. Personal Factor, Age, Household Convenience, Satisfaction with Farming, Goal Free of Debt, Self Evaluation of Adoption. (See Table 8.)

Analysis indicated the importance of three of the four factors. In the Personal Factor, age, household conveniences, and goal being free of debt have a negative influence. That is the older the farmer, the less likelihood he will adopt the practice. If the farmer thought that being feee of debt was important, then there is the tendency not to adopt the practices. If a farmer desired more household conveniences, this also had a negative influence upon adoption. The data indicated the differences in the two counties, as adoption scores were different. Perception of role as an innovator, satisfaction with being in farming were important to the adoption of the practices. In the Participation Factor, the data noted the importance of Agricultural Extension Programs, and Farm Organizations. The variable Farm Equipment Index in the Structural Factor seemed to be the most important explanatory variable in 1962.

Analysis-1966 Data

Farm Practice Scores in 1966 were greater than in 1962 (See Tables 6 and 7.) In 1966 the average farmer in Indiana County used 11 of the 19 practices, an increase of 2 from 1962. For Susquehana the

average was 9, an increase of about one and three fourths practices from 1962. The eighteen independent variables accounted for 51 per cent of the explained variation in the adoption index. With a Step-Wise option, 8 remained accounting for 49 per cent of the explained variation. (See Table 9.)

In the Structural Factor, the most important single explanatory variable in the analysis is the Farm Equipment Index. The analysis indicated a negative relationship with farm income, that is if the farmer has a gross income of less than $2500, he would not adopt the new practices. This would indicate that income serves as a structural constraint. In the Communication Factor, the data indicates the importance of the high status farmers in the area. These may serve to expedite the diffusion process, serving as gatekeepers in the two-step flow of information. Personal Factor variables indicate the negative influence of age as in 1962, the importance of county, and self evaluation of adoption. The relationship between self evaluation and adoption is negative in 1966 as in 1962, as a high score on this index indicates a less favorable image of adoption. Participation Factor in 1966 as in 1962 indicates the importance of Farm Organizations and the Agricultural Extension Service in the diffusion of Innovations.

Discussion

The first hypothesis is accepted. The two counties were not homogeneous. Dairy farmers constituted eighty per cent of the commercial farms in one county, but only thirty four per cent in the other county. It appears the more heterogeneous county has higher adoption scores. This may indicate farmers are exposed to more ideas about farming. Hypothesis number two is also accepted. The scores were higher in 1966 than in 1962.

This would indicate that time is an important element. The farmer needs to evaluate the practice as it is used by others, then incorporate it into his farm operation. The third hypothesis is rejected. Only five variables in three of the four factors appear in both time periods. Variables common to both time periods were: Structural Factor - Farm Equipment Index; Personal Factor - County Residence, Self Evaluation of Adoption; Participation Factor - Participation in Agricultural Extension Programs, and Participation in Farm Organizations.

The research has value for those who design education programs for the diffusion of new ideas and practices. The data indicated a difference in the two counties, the more heterogeneous county having a higher adoption scores. A program must take into account the type of area where the practice is diffused. The Agricultural Extension Service has traditionally served as an instrument to diffuse new ideas and practices, and the research notes the importance of this program. Farm Organizations also serve as instruments in the diffusion process. Again, it appears that people participate in organizations whose goals are similar to their own. The role of the farmer seems to be important in the diffusion process. If he perceives of himself as an innovator, that is one anxious to try new ideas or practices, then he will probably use the practices. Institutions must assist the farmer who desires to learn this new role and sustain him in his efforts to be an innovator. The single most important variable in both time periods is the amount of farm equipment owned. The study would indicate additional inter-disciplinary research is needed by economists, sociologists, and agronomists in determining the amount of equipment needed to implement the new practice, and the minimum size operation needed if the practice is to be profitable for the farmer.

Table 1 Practices in Farm Practice Index

1. Use of complete soil test for each pasture at least once every year.

2. Use of complete soil test for each crop field at least once every year.

3. Regular use of lime on pasture.

4. Regular use of lime on crop fields.

5. Use of fertilizers on pasture.

6. Use of fertilizer on crop fields.

7. Use of top dressing on hay or legumes.

8. Use of alfalfa or trefoil as a grass crop.

9. Band seeding of grasses.

10. Use of spray for leaf hoppers and/or spittle bugs.

11. Use of spray for alfalfa weevil.

12. Sowing of legumes without a nurse crop or cover crop.

13. Use of forage testing.

14. Use of Atrazine for weed control on corn.

15. Use of side band placement attachment on corn planter.

16. Planting corn after corn on the same ground.

17. Use of corn for silage.

18. Keeping of adequate farm records.

19. D.H.I.A. or other owner records for individual cows.

Table 2 Age of Farmer 1962

Age in Years	County	
	Indiana	Susquehana
	-per cent-	-per cent-
Less than 30	3	10
31-40	28	26
41-50	28	29
51-60	30	20
61-70	10	13
Over 71	1	2
Total	100	100
N	148	239
Mean	47.5	45.8
Standard Deviation	10.57	12.5

F = 1.84 N.S. d.f. 1+385

Table 3 Education of Farmer 1962

Years of School Completed	County: Indiana -per cent-	County: Susquehana -per cent-
0	1	1
1-6	4	3
7-9	15	34
10-11	12	16
12	35	43
13-15	1	2
More than 16	2	1
Total	100	100
N	148	239
Mean	9.83	10.20
Standard Deviation	2.54	2.23

F = 2.29 N.S. d.f. 1+385

Table 4 Milking Herd Size 1962

Number of Cows	County	
	Indiana	Susquehana
	-per cent-	-per cent-
12 or less	5	5
13 - 18	17	8
19 - 24	24	25
25 - 30	28	23
31 - 36	11	14
37 - 50	10	17
51 - 100	5	7
More than 100	-	1
Total	100	100
N	148	239
Mean	26.80	30.60
Standard Deviation	11.98	10.40

F = 7.72 Sig. .01 d.f. 1-385

Table 5 Milking Herd Size 1966

Number of Cows	County	
	Indiana	Susquehana
	-per cent-	-per cent-
12 or less	6	7
13 - 18	13	8
19 - 24	34	19
25 - 30	24	19
31 - 36	11	16
37 - 50	15	19
51 - 100	7	11
More than 100	1	1
Total	100	100
Mean	29.30	32.74
Standard Deviation	14.80	16.88

Table 6 Farm Practice Index Scores 1962

Practice Index Score	County	
	Indiana	Susquehana
	-per cent-	-per cent-
.00 - .09	1	5
.10 - .19	4	15
.20 - .29	11	14
.30 - .39	23	22
.40 - .49	20	16
.50 - .59	18	17
.60 - .69	15	8
.70 - .79	7	3
.80 - .89	1	*
.90 - .99	-	-
1.00	-	-
Total	100	100
N	148	239
Mean	.46	.37
Standard Deviation	.16	.17
F = 22.073	p = .001	d.f. 1+385
Bartletts Test	x^2 = .5292	1 d.f. p = .46

Table 7 Farm Practice Index Scores 1966

Practice Index Score	County	
	Indiana	Susquehana
	-per cent-	-per cent-
.00 - .15	2	7
.16 - .30	3	11
.31 - .45	20	29
.46 - .60	30	30
.61 - .75	28	17
Over .76	17	6
Total	100	100
N	148	239
Mean	.57	.46
Standard Deviation	.20	.20

Table 8 Analysis 1962 Data

Multiple R^2 with 18 Independent Variable = .53

Multiple R^2 with 9 Variables in Step-Wise Program = .50

Regression Equation:

$$Y = .2510 + .3545\ x^1 + .0216\ x^2 + .0153\ x^3 + -.0244\ x^4 + .0475\ x^5 + -.0421\ x^6 + .0237\ x^7 + -.0012\ x^8 + -.0085\ x^9$$

x^1 = Farm Equipment Index

x^2 = Extension Participation Index

x^3 = Participation in Farm Organizations

x^4 = Self Evaluation of Adoption

x^5 = Resident - County

x^6 = Goal-Free of Debt

x^7 = Satisfaction with Farming

x^8 = Age

x^9 = Household Convenience Index

Table 9 Analysis 1966 Data

Multiple R^2 with 18 Independent Variables = .51

Multiple R^2 with 8 Variable in Step-Wise Program = .49

Regression Equation:

$$Y = .4122 + .3291\ x^1 + .0160\ x^2 + .0713\ x^3 + -.0031\ x^4 + -.1358\ x^5 + .0040\ x^6 + -.0165\ x^7 + .0149\ x^8$$

x^1 = Farm Equipment Index

x^2 = Extension Participation Index

x^3 = Resident - County

x^4 = Age

x^5 = Gross Farm Sales less than $2500

x^6 = Number of Top 20 Farmers Known

x^7 = Self Evaluation of Adoption

x^8 = Participation in Farm Organizations